

# SCAG Sub-regional Model Development Tool (SMDT)

Sep 28, 2016

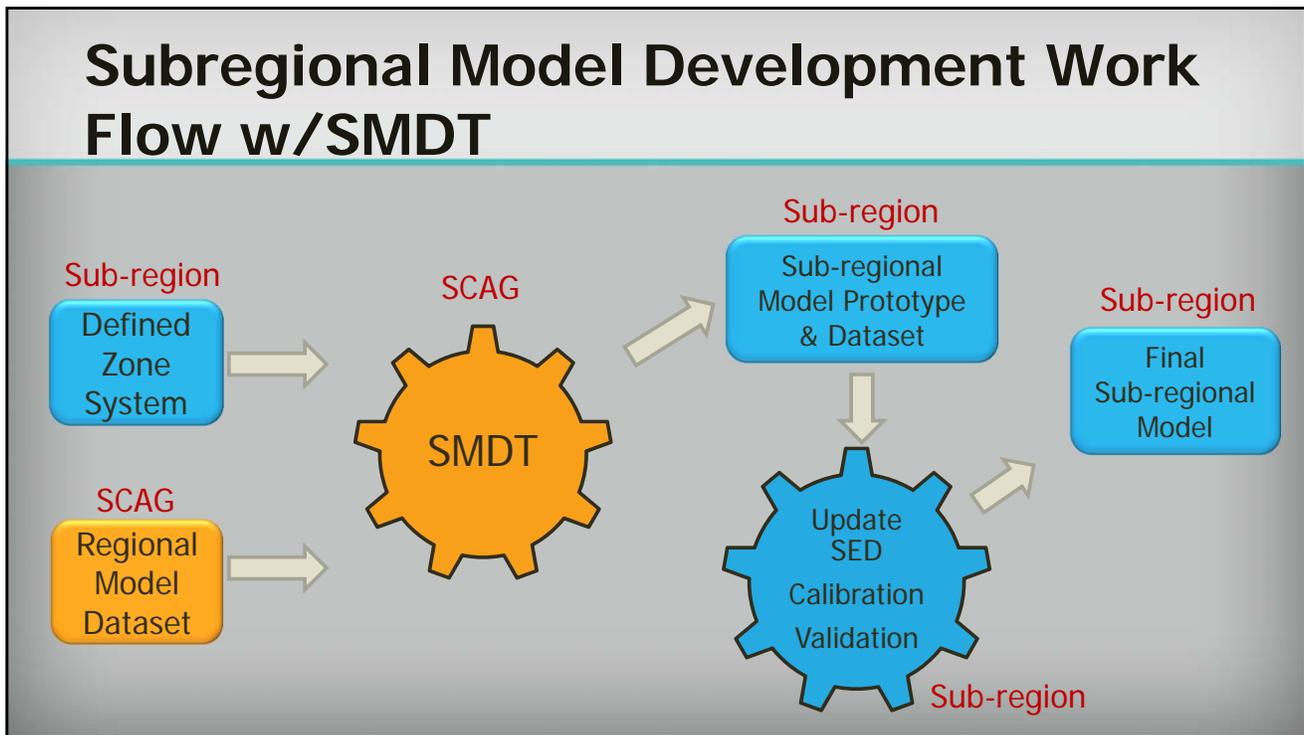
Hao Cheng (SCAG)  
Jim Lam (Caliper)



## Purpose

- To save time and cost on sub-regional model development
- To promote collaboration and model consistency in SCAG Region
- To enhance modeling support among SCAG and member agencies

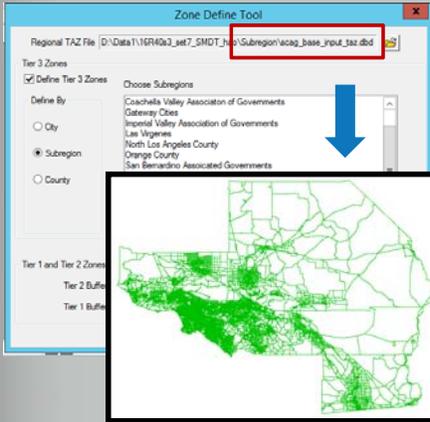
## Subregional Model Development Work Flow w/SMDT



## Four Components of SMDT

- Zone Define Tool
- Data Conversion Tool
- SED Estimation Tool
- Sub-regional Model Prototype
  - Model Executable add-in in TransCAD

# Zone Define Tool



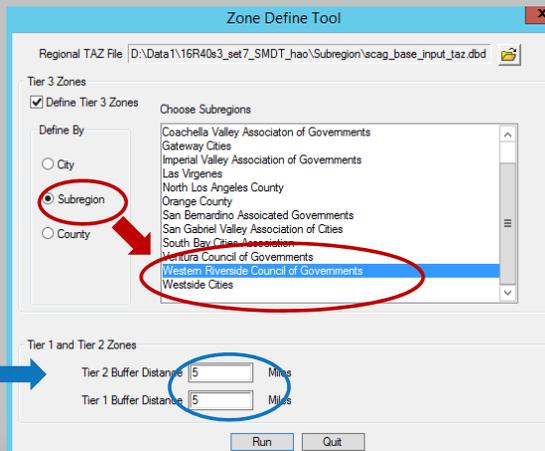
**Input** for Zone Define Tool : A base input TAZ geography file

- 14564 base zone units. A combination of SCAG tier2 and tier3 TAZs
- Base unit can be further split within a tier2 zone

# Zone Define Tool

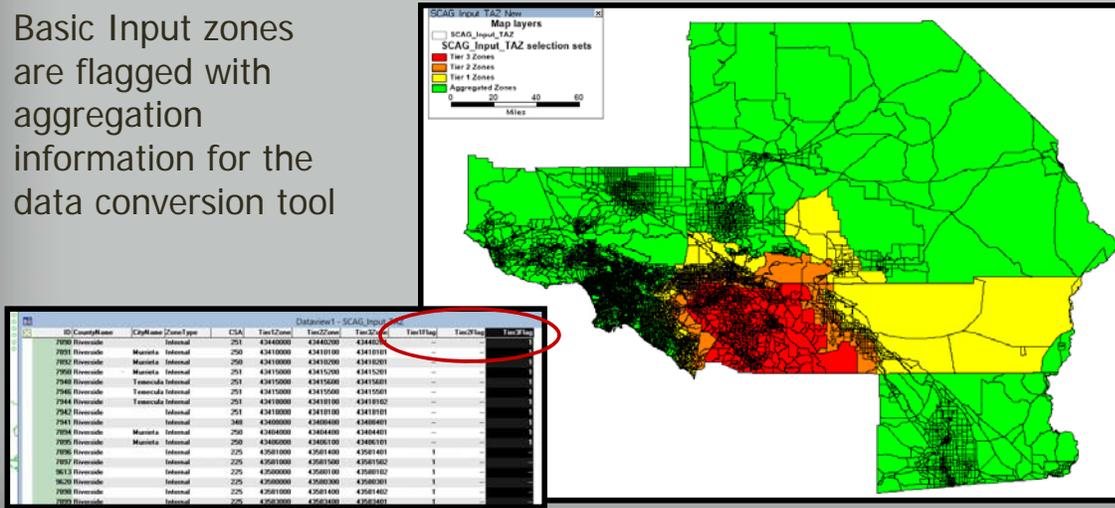
Pick a predefined area

Set Buffer Distance



# Zone Define Tool

Basic Input zones are flagged with aggregation information for the data conversion tool

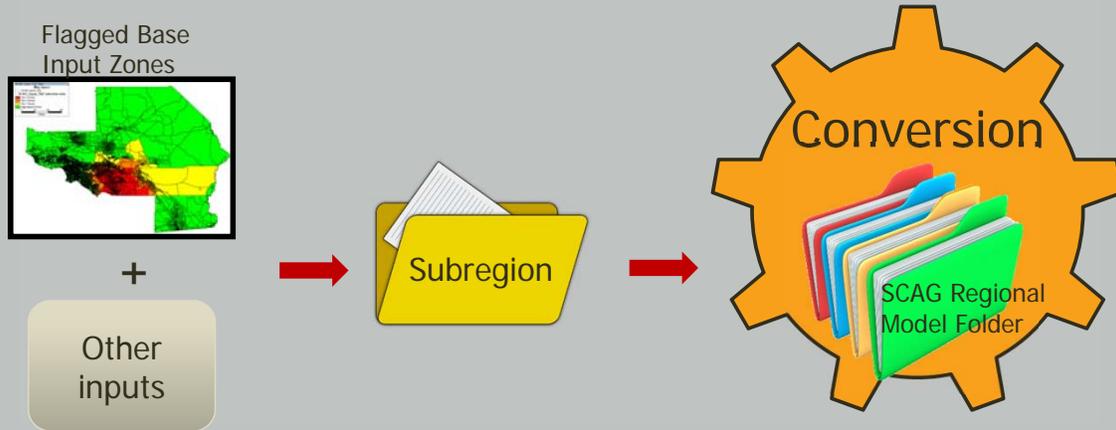


# Zone Define Tool

The three flag attributes can be further adjusted manually

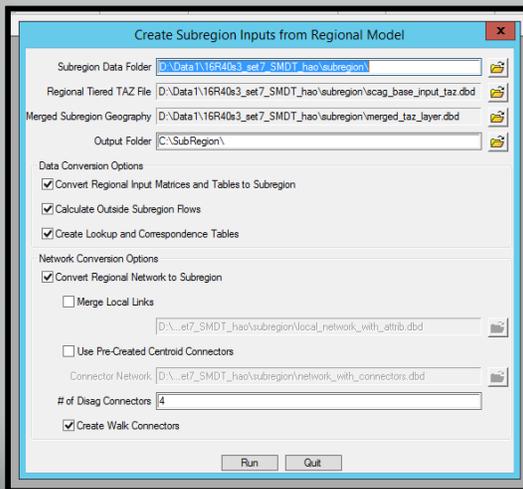
ID	CountyName	CityName	ZoneType	CSA	Tier1Zone	Tier2Zone	Tier3Zone	Tier1Flag	Tier2Flag	Tier3Flag
7890	Riverside	Internal	Internal	251	43440000	43440200	43440201	--	--	1
7891	Riverside	Murietta	Internal	250	43410000	43410100	43410101	--	--	1
7892	Riverside	Murietta	Internal	250	43410000	43410200	43410201	--	--	1
7893	Riverside	Murietta	Internal	251	43415000	43415200	43415201	--	--	1
7894	Riverside	Temecula	Internal	251	43415000	43415500	43415501	--	--	1
7895	Riverside	Temecula	Internal	251	43415000	43418100	43418102	--	--	1
7896	Riverside	Internal	Internal	348	43408000	43408400	43408401	--	--	1
7897	Riverside	Murietta	Internal	250	43404000	43404400	43404401	--	--	1
7898	Riverside	Internal	Internal	250	43406000	43406100	43406101	--	--	1
7899	Riverside	Internal	Internal	225	43581000	43581400	43581401	1	--	1
7899	Riverside	Internal	Internal	225	43581000	43581500	43581502	1	--	1
9613	Riverside	Internal	Internal	225	43580000	43580100	43580102	1	--	1
9620	Riverside	Internal	Internal	225	43580000	43580300	43580301	1	--	1
7898	Riverside	Internal	Internal	225	43581000	43581400	43581402	1	--	1
7899	Riverside	Internal	Internal	225	43583000	43583400	43583401	1	--	1

# Data Conversion Tool



# Data Conversion Tool

## Interface



Converted data saved in a new folder

Options to import local street links and pre-defined centroid connectors into regional network

# Data Conversion Tool

The Output of Data Conversion is a dataset with similar structure as SCAG TBM

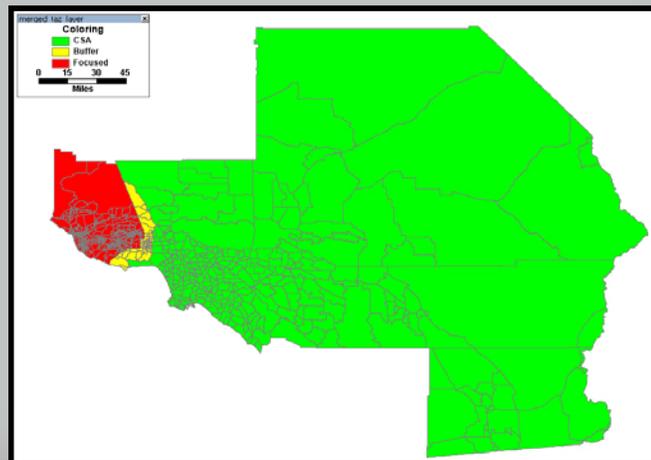
Name	Date modified	Type
Assign	9/20/2016 9:03 PM	File folder
Emission	9/20/2016 9:03 PM	File folder
ExtHDT	9/20/2016 9:03 PM	File folder
ExtLM	9/20/2016 9:03 PM	File folder
Geography	9/21/2016 5:56 PM	File folder
interim	9/21/2016 9:03 PM	File folder
msplit	9/20/2016 9:03 PM	File folder
networks	9/20/2016 9:03 PM	File folder
ODTable	9/20/2016 9:03 PM	File folder
Reports	9/21/2016 3:30 PM	File folder
SED	9/21/2016 3:32 PM	File folder
Skims	9/20/2016 9:03 PM	File folder
TOD	9/20/2016 9:03 PM	File folder
Tripdist	9/20/2016 9:03 PM	File folder
Tripgen	9/20/2016 9:03 PM	File folder
truck	9/20/2016 9:03 PM	File folder
User	9/21/2016 4:55 PM	File folder
SCAGModelv63q.bin	9/22/2016 10:16 PM	BIN File
SCAGModelv63q.DCB	9/21/2016 2:49 PM	DCB File

Name	Date modified
Assign	5/4/2016 2:27 PM
Emission	5/4/2016 2:27 PM
ExtHDT	5/4/2016 2:27 PM
ExtLM	5/4/2016 2:27 PM
Geography	5/4/2016 2:28 PM
interim	5/4/2016 2:28 PM
msplit	5/4/2016 2:39 PM
networks	5/4/2016 2:39 PM
ODTable	5/4/2016 2:40 PM
Reports	5/4/2016 2:40 PM
SED	5/4/2016 2:40 PM
Skims	5/4/2016 2:46 PM
TOD	5/4/2016 2:46 PM
Tripdist	5/4/2016 2:50 PM
Tripgen	5/4/2016 2:50 PM
truck	5/4/2016 2:51 PM
User	5/4/2016 2:52 PM

# Data Conversion Tool

## Keynotes on output

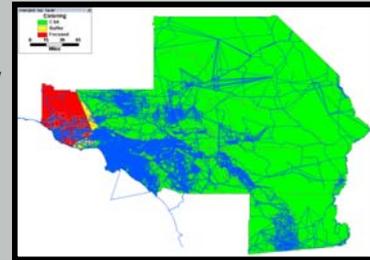
- **Zones** are aggregated based on the flags
- Focused area, buffer area, and aggregated area
- Sample for a focus on Ventura County



# Data Conversion Tool

## Keynotes on output

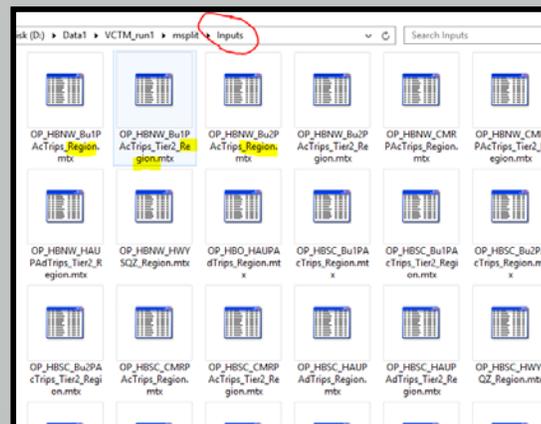
- **Network** has the same **resolution** as the SCAG regional model by default.
- Only extra centroid **connectors** added
- If the **local street** and/or pre-created centroid connectors options are activated they will be integrated into the sub regional network
- The converted sub regional network can be **further edited** in TransCAD manually



# Data Conversion Tool

## Keynotes on output

- **Trips** in **outside area** are preserved at aggregated zone (CSA) level during conversion
- Person trips and vehicle trips
- To maintain the consistency with SCAG regional model



# Data Conversion Tool

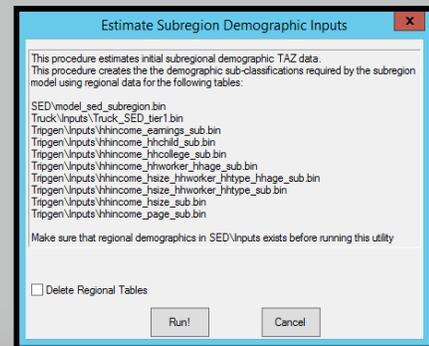
## Keynotes on output

- **SED** is not generated for the **focused** area in data conversion.
- There is a separate tool for SED: SED Estimation Tool

# SED Estimation Tool

## Purposes

- To generate a set of **sandbox** SED for model development and test at an early stage
- To create a draft version of SED as the starting point for SED development



# SED Estimation Tool

- The output can be enhanced by updating the split percentage fields in the TAZ attributes.
- They are used by SED Estimation Tool to split data from an upper level to a lower level
- By default the two fields are calculated by geographic area

Dataview1 - merged_taz_layer_Tier2						
ID	SubregionTAZ	ZoneType	SplitPercentT1	SplitPercentT2	Tier1Zone	Tier2Zone
486	60107101	Internal	0.538	1.000	60107000	60107100
487	60107201	Internal	0.462	1.000	60107000	60107200
488	60108101	Internal	1.000	1.000	60108000	60108100
489	60109101	Internal	0.464	1.000	60109000	60109100
490	60109201	Internal	0.370	1.000	60109000	60109200
491	60109301	Internal	0.165	1.000	60109000	60109300
492	60110101	Internal	1.000	1.000	60110000	60110100
493	60111101	Internal	0.518	1.000	60111000	60111100
494	60112101	Internal	0.482	1.000	60111000	60112100
495	60112201	Internal	0.524	1.000	60112000	60112100
496	60112201	Internal	0.476	1.000	60112000	60112200
497	60113101	Internal	0.393	1.000	60113000	60113100
498	60113201	Internal	0.140	1.000	60113000	60113200
499	60113301	Internal	0.144	1.000	60113000	60113300
500	60113401	Internal	0.060	1.000	60113000	60113400
501	60113501	Internal	0.263	1.000	60113000	60113500
502	60114101	Internal	0.460	1.000	60114000	60114100
503	60114201	Internal	0.540	1.000	60114000	60114200
504	60115101	Internal	0.500	1.000	60115000	60115100

# SED Estimation Tool

- SED for sub-regional model is in a similar structure as SCAG regional model except it only has one tier of zones.
- Include:
  - One master SED table in \SED\
  - Eight joined distribution tables in \Tripgen\Inputs\
  - One truck SED table in \Truck\Inputs\

## SED Estimation Tool

- Tier2 TAZ is the minimum geographic unit in SCAG regional model. Converting SED from regional model to a finer resolution will cause inevitable bias.
- Ideally the SED for focused area should be prepared by the user of the sub-regional model
- There is a utility included in Sub-regional Model Prototype to assist SED update.

## Sub-regional Model Prototype

# Sub-regional Model Prototype

- User provides custom demographics for the subregion TAZs
- Only a small subset of the SCAG demographic variables are required
- Override utility will estimate all related demographic fields

The top screenshot shows a data table with the following columns: ID, OVERTAZ, HOUSEHOLDS, POPULATION, and TOTALEMPLOYMENT. The data is as follows:

ID	OVERTAZ	HOUSEHOLDS	POPULATION	TOTALEMPLOYMENT
4	20318101	256	1096	343
5	20291901	2	6	0
7	20333602	10	28	8
8	20375201	0	0	0
9	20390301	1	4	0
10	20288701	0	0	0
11	20255801	30	185	11
12	20364202	40	139	0
13	20383207	0	0	0
14	20259302	19	67	13
15	20383412	0	0	783

The bottom screenshot shows the 'Override Subregion Demographic Inputs' dialog box. It contains the following text:

This procedure re-estimates subregional demographic TAZ data. You provide an override demographics table containing updated population, household and employment data by subregional TAZ. This procedure estimates the demographic sub-classifications required by the subregion model for the following tables:

```

SED\model_sed_subregion.bin
Truck\Inputs\Truck_SED_ser1.bin
Trippen\Inputs\hhincome_earnings_sub.bin
Trippen\Inputs\hhincome_hhchild_sub.bin
Trippen\Inputs\hhincome_hhcollege_sub.bin
Trippen\Inputs\hhincome_hhworker_hhage_sub.bin
Trippen\Inputs\hhincome_hsize_hhworker_hhtype_hhage_sub.bin
Trippen\Inputs\hhincome_hsize_hhworker_hhtype_sub.bin
Trippen\Inputs\hhincome_hsize_sub.bin
Trippen\Inputs\hhincome_page_sub.bin
  
```

Override Demographics Table:

Create table backups

Buttons: Run, Cancel

# Sub-regional Model Prototype

- Sub-regional Model Prototype is a fully functional model
- Built on TransCAD platform as an add-in
- User Interface is similar as SCAG regional model UI



## Sub-regional Model Prototype

- Sub-regional Model Prototype inherits coefficients from SCAG regional model
- Need further calibration and validation for the focused area



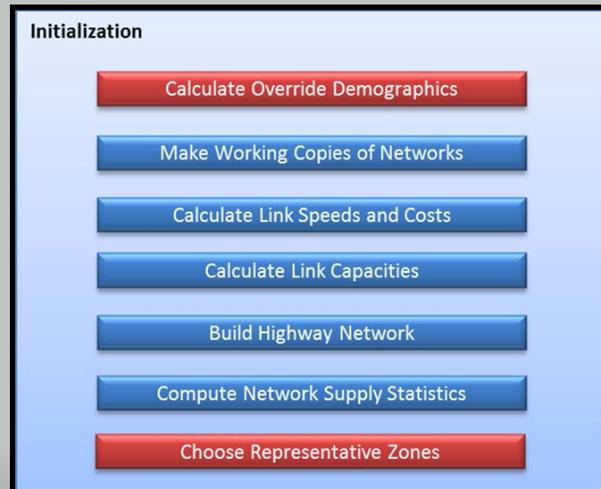
## Sub-regional Model Prototype

Sub-regional Model Prototype consists of the following stages:

- Initialization
- Network Skimming
- Trip Generation
- Trip Distribution
- Modal Split
- Time of Day Models
- Trip Assignment

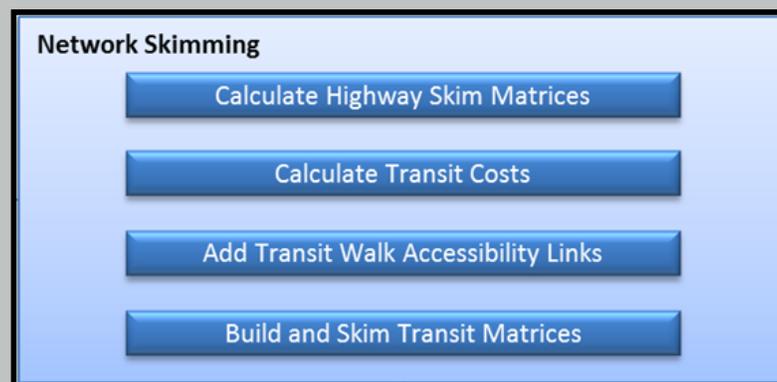
# Sub-regional Model Prototype

- Initialization
- Network Skimming
- Trip Generation
- Trip Distribution
- Modal Split
- Time of Day Models
- Trip Assignment



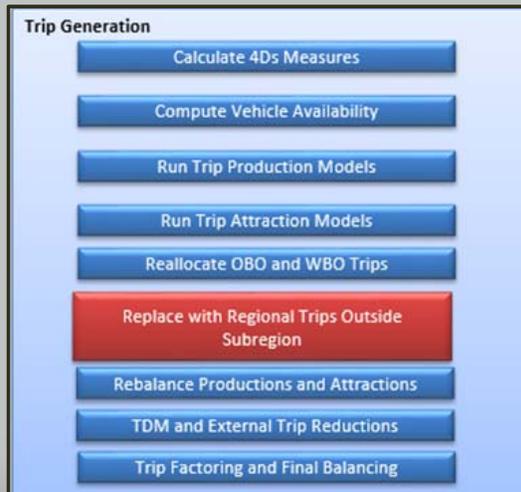
# Sub-regional Model Prototype

- Initialization
- Network Skimming
- Trip Generation
- Trip Distribution
- Modal Split
- Time of Day Models
- Trip Assignment



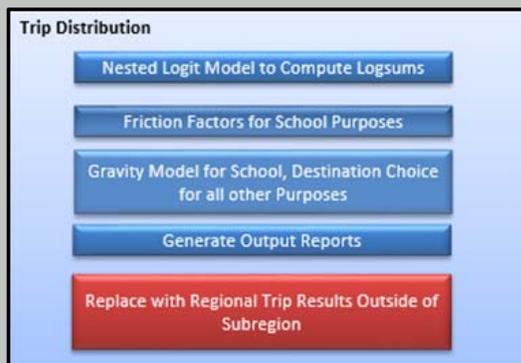
# Sub-regional Model Prototype

- Initialization
- Network Skimming
- **Trip Generation**
- Trip Distribution
- Modal Split
- Time of Day Models
- Trip Assignment



# Sub-regional Model Prototype

- Initialization
- Network Skimming
- Trip Generation
- **Trip Distribution**
- Modal Split
- Time of Day Models
- Trip Assignment



HC1

HC1      update to DC model  
Hao Cheng, 9/26/2016

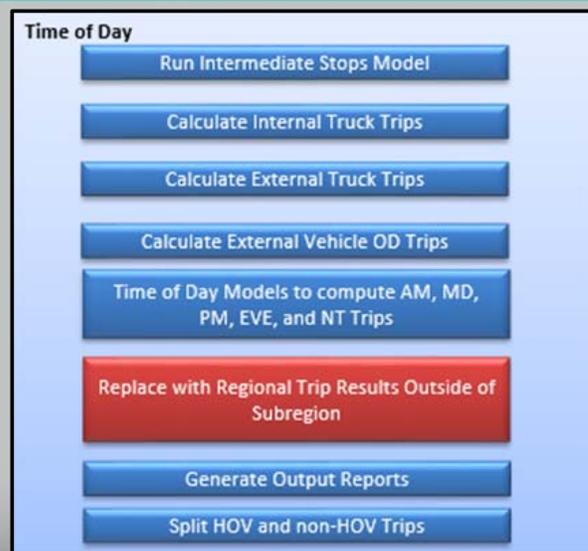
# Sub-regional Model Prototype

- Initialization
- Network Skimming
- Trip Generation
- Trip Distribution
- **Modal Split**
- Time of Day Models
- Trip Assignment



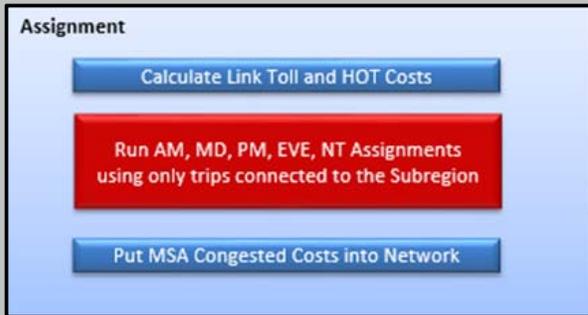
# Sub-regional Model Prototype

- Initialization
- Network Skimming
- Trip Generation
- Trip Distribution
- Modal Split
- **Time of Day Models**
- Trip Assignment



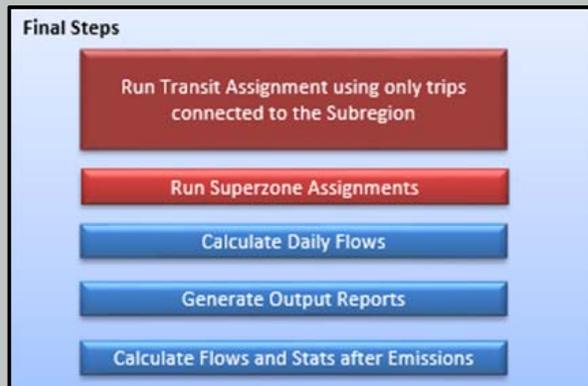
# Sub-regional Model Prototype

- Initialization
- Network Skimming
- Trip Generation
- Trip Distribution
- Modal Split
- Time of Day Models
- Trip Assignment



# Sub-regional Model Prototype

- Initialization
- Network Skimming
- Trip Generation
- Trip Distribution
- Modal Split
- Time of Day Models
- Trip Assignment



# Sub-regional Model Prototype

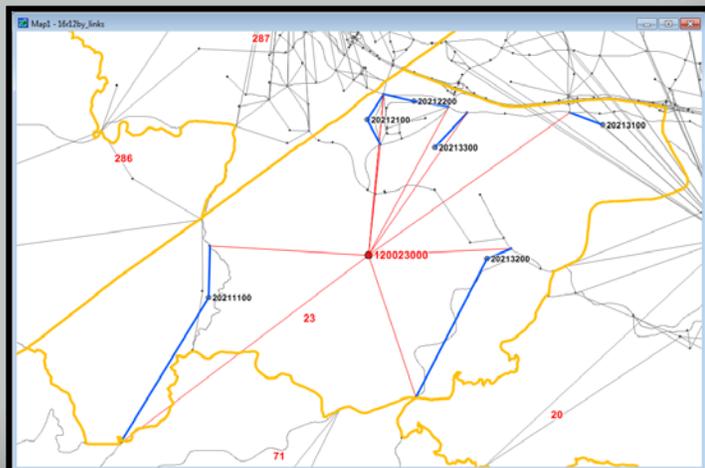
## Traffic/Transit Assignment in Sub-regional Model Prototype

- The assignment model is a focused assignment which only assigns trips that start or end in the focused area.
- Region-wide level traffic and transit volumes that are unconnected to the focused area are used as preload volumes to the assignments.
- The Assignments extract only the trips that start or end in the focused area and assign these trips

# Sub-regional Model Prototype

## Superzone Assignments

- Outside the subregion, trips are accessed through superzones which are fairly long centroid connectors
- Superzone assignment re-positions these trips to go through local connectors to better estimate local flows
- Only trips from the superzone to a subregion zone are affected



# Sub-regional Model Prototype

## Sub-regional Model Prototype Performance

- The SMP can generate consistent output with SCAG regional model at county level
- In a variety of output:
  - Person trip
  - Mode share
  - Vehicle trip
  - VMT

# Sub-regional Model Prototype

## Person trip summary

\* Ventura County is the focused area

Reg Mod						
cnty	Prod_PK	Prod_OP	Prod Day	Attr_PK	Attr_OP	Attr_Day
1	254,540	238,682	493,222	255,001	238,713	493,714
2	16,948,770	17,751,347	34,700,117	17,078,497	17,830,529	34,909,027
3	5,435,961	5,728,637	11,164,598	5,642,022	5,838,822	11,480,844
4	3,607,453	3,649,349	7,256,802	3,411,137	3,542,021	6,953,158
5	3,401,462	3,454,428	6,855,890	3,299,208	3,393,556	6,692,764
6	1,435,662	1,478,349	2,914,012	1,407,943	1,459,185	2,867,128
			63,384,641			63,396,634
Sub Mod						
cnty	Prod_PK	Prod_OP	Prod Day	Attr_PK	Attr_OP	Attr_Day
1	253,591	236,509	490,100	252,200	236,237	488,437
2	16,958,379	17,772,352	34,730,731	17,087,030	17,852,960	34,939,990
3	5,434,469	5,727,170	11,161,639	5,643,968	5,841,034	11,485,001
4	3,603,768	3,646,391	7,250,159	3,410,344	3,541,091	6,951,435
5	3,400,330	3,451,251	6,851,582	3,299,279	3,391,014	6,690,293
6	1,435,895	1,478,641	2,914,536	1,408,196	1,459,540	2,867,736
			63,398,746			63,422,891
%						
cnty	Prod_PK	Prod_OP	Prod Day	Attr_PK	Attr_OP	Attr_Day
1	1.00	0.99	0.99	0.99	0.99	0.99
2	1.00	1.00	1.00	1.00	1.00	1.00
3	1.00	1.00	1.00	1.00	1.00	1.00
4	1.00	1.00	1.00	1.00	1.00	1.00
5	1.00	1.00	1.00	1.00	1.00	1.00
6	1.00	1.00	1.00	1.00	1.00	1.00
			1.00			1.00

# Sub-regional Model Prototype

## Mode Share Summary

\* Ventura County is the focused area

Reg Mod	DA	SR2	SR3	Passenger	Transit	NM
Imperial	0.44	0.08	0.06	0.23	0.00	0.18
Los Angeles	0.40	0.07	0.08	0.28	0.03	0.13
Orange	0.44	0.08	0.08	0.28	0.01	0.11
Riverside	0.46	0.08	0.08	0.27	0.00	0.11
San Bernardino	0.45	0.08	0.08	0.27	0.00	0.11
Ventura	0.486	0.077	0.069	0.250	0.005	0.113
SCAG	0.42	0.08	0.08	0.28	0.02	0.12
sub Mod	DA	SR2	SR3	Passenger	Transit	NM
Imperial	0.44	0.08	0.06	0.23	0.00	0.18
Los Angeles	0.40	0.08	0.08	0.28	0.03	0.13
Orange	0.44	0.08	0.08	0.28	0.01	0.11
Riverside	0.46	0.08	0.08	0.27	0.00	0.11
San Bernardino	0.45	0.08	0.08	0.27	0.00	0.11
Ventura	0.487	0.077	0.068	0.250	0.005	0.112
SCAG	0.42	0.08	0.08	0.28	0.02	0.12
delta share	DA	SR2	SR3	Passenger	Transit	NM
Imperial	0.000	0.000	0.000	0.000	0.000	0.000
Los Angeles	0.002	0.001	0.000	0.000	-0.001	-0.001
Orange	0.000	0.000	0.000	0.000	0.000	0.000
Riverside	0.000	0.000	0.000	0.000	0.000	0.000
San Bernardino	0.000	0.000	0.000	0.000	0.000	0.000
Ventura	0.0016	0.0003	-0.0003	-0.0004	-0.0006	-0.0006
SCAG	0.001	0.000	0.000	0.000	0.000	-0.001

# Sub-regional Model Prototype

## Vehicle Trip Summary

\* Ventura County is the focused area

Reg Mod	1	2	3	4	5	6	TOT	HDT	1	2	3	4	5	6	TOT
LM	1	2	3	4	5	6	TOT	1	2	3	4	5	6	TOT	
1	353,342	635	232	7,532	581	64	362,387	1	13,142	362	98	316	351	104	14,373
2	581	18,736,164	943,999	122,903	378,000	224,013	20,405,662	2	333	533,565	45,529	18,500	27,975	11,867	637,830
3	340	946,999	5,995,563	132,857	100,653	6,908	7,183,319	3	98	45,385	124,029	7,383	7,382	4,583	188,860
4	7,391	123,432	127,686	3,921,041	387,765	2,998	4,570,313	4	316	18,702	7,382	61,991	14,353	1,184	103,927
5	497	375,314	97,345	387,283	3,455,583	4,731	4,320,753	5	351	28,260	7,384	14,357	78,218	1,413	129,983
6	27	225,478	6,567	2,603	5,093	1,662,404	1,902,172	6	104	11,942	4,583	1,185	1,412	33,681	52,907
TOT	362,179	20,408,022	7,171,392	4,574,219	4,327,675	1,901,119	38,744,606	TOT	14,344	638,217	189,004	103,792	129,691	52,832	1,127,881
Sub Mod	1	2	3	4	5	6	TOT	HDT	1	2	3	4	5	6	TOT
LM	1	2	3	4	5	6	TOT	1	2	3	4	5	6	TOT	
1	353,342	638	232	7,532	581	61	362,387	1	13,142	367	98	316	351	110	14,385
2	585	18,969,210	949,799	123,082	378,434	236,132	20,657,242	2	338	532,758	45,250	18,499	27,857	11,569	636,272
3	340	954,960	5,995,563	132,857	100,653	7,083	7,191,455	3	98	45,107	124,029	7,383	7,382	4,453	188,452
4	7,391	123,818	127,686	3,921,041	387,765	2,873	4,570,573	4	316	18,641	7,382	61,991	14,353	1,103	103,785
5	497	376,308	97,345	387,283	3,455,583	4,537	4,321,553	5	351	28,142	7,384	14,357	78,218	1,377	129,829
6	24	237,583	6,415	2,457	4,851	1,675,139	1,926,489	6	110	11,644	4,453	1,103	1,376	33,918	52,605
TOT	362,180	20,662,517	7,177,040	4,574,251	4,327,866	1,925,825	39,029,679	TOT	14,356	636,659	188,596	103,649	129,537	52,530	1,125,327
%	1	2	3	4	5	6	TOT	HDT	1	2	3	4	5	6	TOT
LM	1	2	3	4	5	6	TOT	1	2	3	4	5	6	TOT	
1	1.00	1.01	1.00	1.00	1.00	0.95	1.000	1	1.00	1.01	1.00	1.00	1.00	1.06	1.001
2	1.01	1.01	1.01	1.00	1.00	1.05	1.012	2	1.02	1.00	0.99	1.00	1.00	0.97	0.998
3	1.00	1.01	1.00	1.00	1.00	1.03	1.001	3	1.00	0.99	1.00	1.00	1.00	0.97	0.998
4	1.00	1.00	1.00	1.00	1.00	0.96	1.000	4	1.00	1.00	1.00	1.00	1.00	0.93	0.999
5	1.00	1.00	1.00	1.00	1.00	0.96	1.000	5	1.00	1.00	1.00	1.00	1.00	0.97	0.999
6	0.91	1.05	0.98	0.94	0.95	1.01	1.013	6	1.06	0.98	0.97	0.93	0.97	1.01	0.994
TOT	1.00	1.01	1.00	1.00	1.00	1.01	1.007	TOT	1.00	1.00	1.00	1.00	1.00	0.99	0.998

# Sub-regional Model Prototype

## VMT Summary

\*Ventura County is the focused area

Reg Mod						HDT					
LM	VC SCCAB	SCAB	MDAB	SSAB	TOT	1	VC SCCAB	SCAB	MDAB	SSAB	TOT
1	-	-	-	4,220,501	4,220,501	1	-	-	-	519,691	519,691
2	-	202,147,241	7,259,223	-	209,406,465	2	-	12,846,952	347,707	-	13,194,659
3	-	70,105,903	-	-	70,105,903	3	-	3,481,161	-	-	3,481,161
4	-	44,994,646	1,403,702	9,504,096	55,902,445	4	-	2,839,859	749,949	1,247,660	4,837,468
5	-	35,196,650	19,158,784	-	54,355,434	5	-	2,404,558	3,611,983	-	6,016,541
6	16,948,905	-	-	-	16,948,905	6	1,407,494	-	-	-	1,407,494
<b>TOT</b>	16,948,905	352,444,440	27,821,710	13,724,597	410,939,652	<b>TOT</b>	1,407,494	21,572,531	4,709,638	1,767,351	29,457,015

Sub Mod						HDT					
LM	VC SCCAB	SCAB	MDAB	SSAB	TOT	1	VC SCCAB	SCAB	MDAB	SSAB	TOT
1	-	-	-	4,163,113	4,163,113	1	-	-	-	518,179	518,179
2	-	205,539,753	7,106,141	-	212,645,893	2	-	12,593,576	344,249	-	12,937,825
3	-	70,461,140	-	-	70,461,140	3	-	3,461,271	-	-	3,461,271
4	-	45,079,501	1,531,050	9,728,559	56,339,110	4	-	2,830,855	760,352	1,252,824	4,844,030
5	-	35,548,021	19,852,639	-	55,400,660	5	-	2,385,040	3,643,331	-	6,028,371
6	17,426,847	-	-	-	17,426,847	6	1,407,913	-	-	-	1,407,913
<b>TOT</b>	17,426,847	356,628,415	28,489,830	13,891,672	416,436,763	<b>TOT</b>	1,407,913	21,270,742	4,747,932	1,771,003	29,197,590

%						HDT					
LM	VC SCCAB	SCAB	MDAB	SSAB	TOT	1	VC SCCAB	SCAB	MDAB	SSAB	TOT
1				0.99	0.99	1				1.00	1.00
2		1.02	0.98		1.02	2		0.98	0.99		0.98
3		1.01			1.01	3		0.99			0.99
4		1.00	1.09	1.02	1.01	4		1.00	1.01	1.00	1.00
5		1.01	1.04		1.02	5		0.99	1.01		1.00
6	1.03				1.03	6	1.00				1.00
<b>TOT</b>	1.03	1.01	1.02	1.01	1.01	<b>TOT</b>	1.00	0.99	1.01	1.00	0.99

Question?

Thank You !

